

REMARKS

Claims 1-11 are pending. Reconsideration and allowance are respectfully requested in light of the following remarks.

Rejections Under 35 U.S.C. § 103

A. Claims 1-4 and 9 were rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 6,905,618 to Matthews et al. ("Matthews") in view of U.S. Patent No. 4,808,542 to Reichert et al. ("Reichert"). The rejection is respectfully traversed.

Claim 1 recites a method for forming a stepped profile from a layer sequence in which: a) in a first patterning step, a first layer partial sequence, which is at least partially covered by a photoresist layer, is removed apart from a first residual layer partial sequence, b) in a second patterning step, a second layer partial sequence located below the first layer partial sequence is partially removed by means of etching with a second etchant, c) in a third patterning step, a third layer partial sequence located below the second layer partial sequence is partially removed by means of etching with a third etchant, wherein: d) in the second patterning step, a region of the second layer partial sequence that is located below the first residual layer partial sequence is removed, by which a first projection of the first residual layer partial sequence being formed, and e) in the third patterning step, the first projection of the first residual layer partial sequence is removed, wherein the photoresist layer remains during the first, second and third patterning steps (emphasis added).

Applicants respectfully submit that the combination of Matthews and Reichert does not suggest the method of forming a stepped profile from a layer sequence

recited in claim 1 for at least the following reasons. Matthews discloses methods of making diffractive optical elements. Figure 1 shows a stack of layers formed on a substrate 12 prior to processing the stack. The stack includes, in the following order, phase shift layer 20, etch stop layer 26, phase shift layer 18, etch stop layer 24, phase shift layer 16, etch stop layer 22, phase shift layer 14 and oxide cap layer 28 forming the top layer of the stack. Figure 2A shows a first photoresist layer 30 overlying the phase shift layer 14.

As shown in Figure 2B, in a first etch step, a portion of phase shift layer 14 is removed by plasma etching. This etching does not remove the etch stop layer 22, which protects the phase shift layer 16. In fact, Matthews discloses that "[p]hase shift layer 14 is etched using a conventional plasma etcher until the etch process effectively stops at the etch stop layer 22" (emphasis added). Col. 4, ll. 42-43.

Accordingly, the etch stop layer 22 is provided to prevent etching of the phase shift layer 16. As shown in Figure 2B, the photoresist layer 30 is removed. As shown in Figure 2C, a portion of the etch stop layer 22 is removed by a wet etching technique after removing the photoresist layer 30. Col. 4, ll. 43-47. As shown in Figure 3A, a second photoresist layer 32 is then applied over the phase shift layer 14 and over a portion of phase shift layer 16. As shown in Figure 3B, a portion of the phase shift layer 16 is then removed by plasma etching. This plasma etching does not remove the etch stop layer 24, which is provided to protect the underlying phase shift layer 18. As shown in Figure 3C, a portion of the etch stop layer 24 provided on the phase shift layer 18 is removed by a wet etching technique. Col. 4, ll. 58-62. The photolithography and etching steps are repeated with respect to the phase shift

layers 18 and 20 and the etch stop layer 26 to produce the final optical structure 34 shown in Figure 4. Col. 4, lines 63-66.

Accordingly, Matthew's method lacks various features of the method of claim 1. For example, claim 1 recites "a) in a first patterning step, a first layer partial sequence, which is at least partially covered by a photoresist layer, is removed apart from a first residual layer partial sequence." The Office asserts that Matthews discloses a first patterning step wherein "a first partial layer sequence 22, which is at least partially covered by a photoresist layer 30, is removed apart from a first residual layer partial sequence 14 (Figure 2B) (emphasis added)." However, during Matthew's first etch step depicted in Figure 2B, a portion of the phase shift layer 14 (which is covered by photoresist layer 30) is removed, but the etch stop layer 22 is not removed. In fact, Matthews teaches away from such removal of the etch stop layer 22 during this etch step as this removal would allow the phase shift layer 16 to also be etched during this same step, which Matthews prevents.

Also, the photoresist layer 30 does not remain on the stack after the first etch step, as can be seen by comparing Figures 2A and 2B of Matthews. To the contrary, Matthews applies a second photoresist layer 32 before etching the phase shift layer 16 located below the phase shift layer 14. Thus, Matthews also does not suggest the feature that "the photoresist layer remains during the first, second and third patterning steps," as recited in claim 1. In stark contrast, Matthews applies a new photoresist layer before each successive phase shift layer is etched, and thus applies multiple photoresist layers in order to complete the process.

The method recited in claim 1 is advantageous for various reasons, including that only one photoresist layer is applied, and this layer remains during all patterning

steps. The claimed method provides accurate results in a simplified manner, with a reduced number of process steps.

Reichert does not suggest modifying Matthews' process to result in the method recited in claim 1. For example, Reichert does not suggest modifying Matthews' process to include the feature that "the photoresist layer remains during the first, second and third patterning steps," as claimed. Accordingly, the Office has not articulated a reason to combine the teachings of Matthews and Reichert to result in the method claimed. Thus, claim 1 would not have been rendered obvious by the applied references.

Claims 2-4 and 9, which depend from claim 1, are also patentable over the applied references for at least the same reasons as those for which claim 1 is patentable. Therefore, withdrawal of the rejection is respectfully requested.

B. Claim 5 was rejected under 35 U.S.C. § 103(a) over Matthews in view of Reichert, and further in view of U.S. Patent No. 6,156,662 to Ohori et al. ("Ohori"). The rejection is respectfully traversed.

Claim 5 depends from claim 1. The Office acknowledges that Matthews and Reichert fail to suggest the features of claim 5. However, the Office asserts that Ohori cures the deficiencies of Matthews and Reichert in regard to claim 5. Applicants respectfully disagree.

Regarding claim 1, Ohori also does not provide any reason to modify Matthews' process to include the features that "the photoresist layer remains during the first, second and third patterning steps," for example.

Furthermore, claim 5 recites that "in the first patterning step, the first layer partial sequence is removed to an extent such that a second projection of the photoresist layer arises, which second projection has a length t_1 greater than a thickness d_1 of the first layer partial sequence." In contrast, in Matthews process, the etching step used to etch the phase shift layer 14 does not affect the phase shift layer 16, because this etching is stopped by the etch stop layer 22 formed on the phase shift layer 16.

Applicants submit that the Office has not articulated a reason why one skilled in the art would have combined the teachings of Matthews, Reichert and Ohori to result in the method recited in claim 5, or established that these references would have suggested every feature of claim 5 even if combined. Thus, claim 5 would not have been rendered obvious by the applied references. Therefore, withdrawal of the rejection is respectfully requested.

C. Claims 6, 7 and 10 were rejected under 35 U.S.C. § 103(a) over Matthews in view of Reichert, and further in view of U.S. Patent No. 3,663,184 to Wood et al. ("Wood"). The rejection is respectfully traversed.

Claims 6, 7 and 10 depend directly or ultimately from claim 1. The Office acknowledges that Matthews and Reichert fail to suggest the features of these dependent claims, but asserts that Wood cures the deficiencies of Matthews and Reichert.

Applicants submit that the Office has not articulated a reason why one skilled in the art would have combined the teachings of Matthews, Reichert and Wood to result in the method recited in claim 1, or established that these references would

have suggested every feature of claims 6, 7 and 10 even if combined. Thus, dependent claims 6, 7 and 10 also would not have been rendered obvious by the applied references. Therefore, withdrawal of the rejection is respectfully requested.

D. Claims 8 and 11 were rejected under 35 U.S.C. § 103(a) over Matthews in view of Reichert, and further in view of U.S. Patent No. 5,160,492 to Wang et al. ("Wang"). The rejection is respectfully traversed.

Claims 8 and 11 depend ultimately from claim 1. The Office acknowledges that Matthews and Reichert fail to suggest the features of claims 8 and 11, but asserts that Wang cures the deficiencies of Matthews and Reichert. Applicants respectfully disagree.

Applicants submit that the Office has not articulated a reason why one skilled in the art would have combined the teachings of Matthews, Reichert and Wang to result in the method recited in claim 1, or established that these references would have suggested every feature of claims 8 and 11 even if combined. Thus, dependent claims 8 and 11 also would not have been rendered obvious by the applied references. Therefore, withdrawal of the rejection is respectfully requested.

Conclusion

Therefore, allowance of the application is respectfully requested. If the Examiner has any questions concerning this reply or the application in general, the undersigned can be reached at the number given below.

Respectfully submitted,

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